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MONTHLY
MICROCLIMATIC SUMMARY

JULY 1967

ENVIRONMENTAL DATA BASE
FOR REGIONAL STUDIES IN THE HUMID TROPICS

USATECOM Project No. 74-0013-01

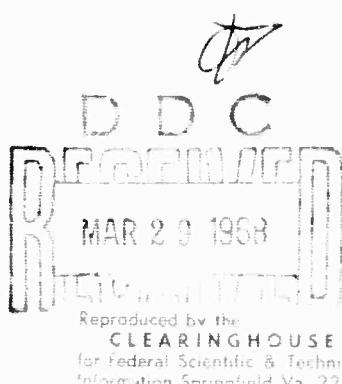
US ARMY
TROPIC TEST CENTER
Fort Clayton, Canal Zone

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MONTHLY
MICROCLIMATIC SUMMARY

JULY 1967

Prepared by

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UEATECOM Project No. 9-4-0013-01

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MONTHLY MICROCLIMATIC SUMMARY

Introduction

Monthly microclimatic data summarized in this series of reports were collected by the US Army Tropic Test Center and the Weather Engineers of Panama Corporation under the project, Environmental Data Base for Regional Studies in the Humid Tropics. The project is sponsored by the Advanced Research Projects Agency of the Department of Defense and by the Army Research Office, Office of the Chief of Research and Development. It is an investigation of microclimatic, air chemistry, vegetation, soils, microbiological, and macrofaunal conditions at selected sites in the principal tropical environments of the Panama Canal Zone and the Rio Hato Military Reservation. The objective of the project is to assemble quantitative environmental data for RDT&E purposes.

Sites. Data summarized in this report were collected at the Albrook Forest and Chiva Chiva sites. Figure 1 shows the site locations within the Isthmus of Panama. Geographic coordinates are shown below:

Albrook Forest	09° 01'N, 79° 33'W
Chiva Chiva	09° 01'N, 79° 35'W

The Chiva Chiva open site and the Albrook Forest site are paired for comparative study of environmental conditions in a tropical semideciduous forest and in a large clearing. Both are located in a region where the annual precipitation is approximately 80 inches and there is a pronounced dry season. The other satellite sites were located primarily for soil studies purposes. Albrook and Fort Kobbe have climatic regimes similar to the principal sites.

The Albrook and Chiva Chiva main sites are approximately four kilometers apart. Each has a 46 meter walk-up tower and an air-conditioned building to house the recording equipment and observers. Both sites are approximately 30 meters above sea level. The top of the forest canopy at the Albrook site is about 26.5 meters above the ground.

Instrumentation. A wide range of climatic elements are measured at the Albrook and Chiva Chiva sites. Types of observations and frequencies are shown on Figure 2. The towers at the Albrook and Chiva Chiva sites are similarly oriented. Sensing equipment is mounted at several levels on the towers to provide measurements through the vertical profile. Additional instruments are emplaced in the immediate vicinity on or near the ground. All instrument exposures are duplicated at each site. Figures 3, 4, and 5 show the instrument array at these sites.

Data Reduction and Storage. All data, as applicable, are recorded at or reduced to each full hour and transposed to punch cards. These punch cards, together with all raw data, are stored in the Tropic Test Center Technical Library Annex.

The relative humidity data contained in this report required some adjustment due to the difficult problems in maintaining hair hygrometers in the humid tropics. The hygrometers show saturation at a time when the psychrometer shows a relative humidity well below 100%. For this reason the hourly measurements made by means of a hair hygrometer have been modified on the basis of simultaneous psychrometer readings of other levels. Details will be given in the fourth Semianual Report. It can be assumed that the means of relative humidity presented in this volume are very close to the true means.

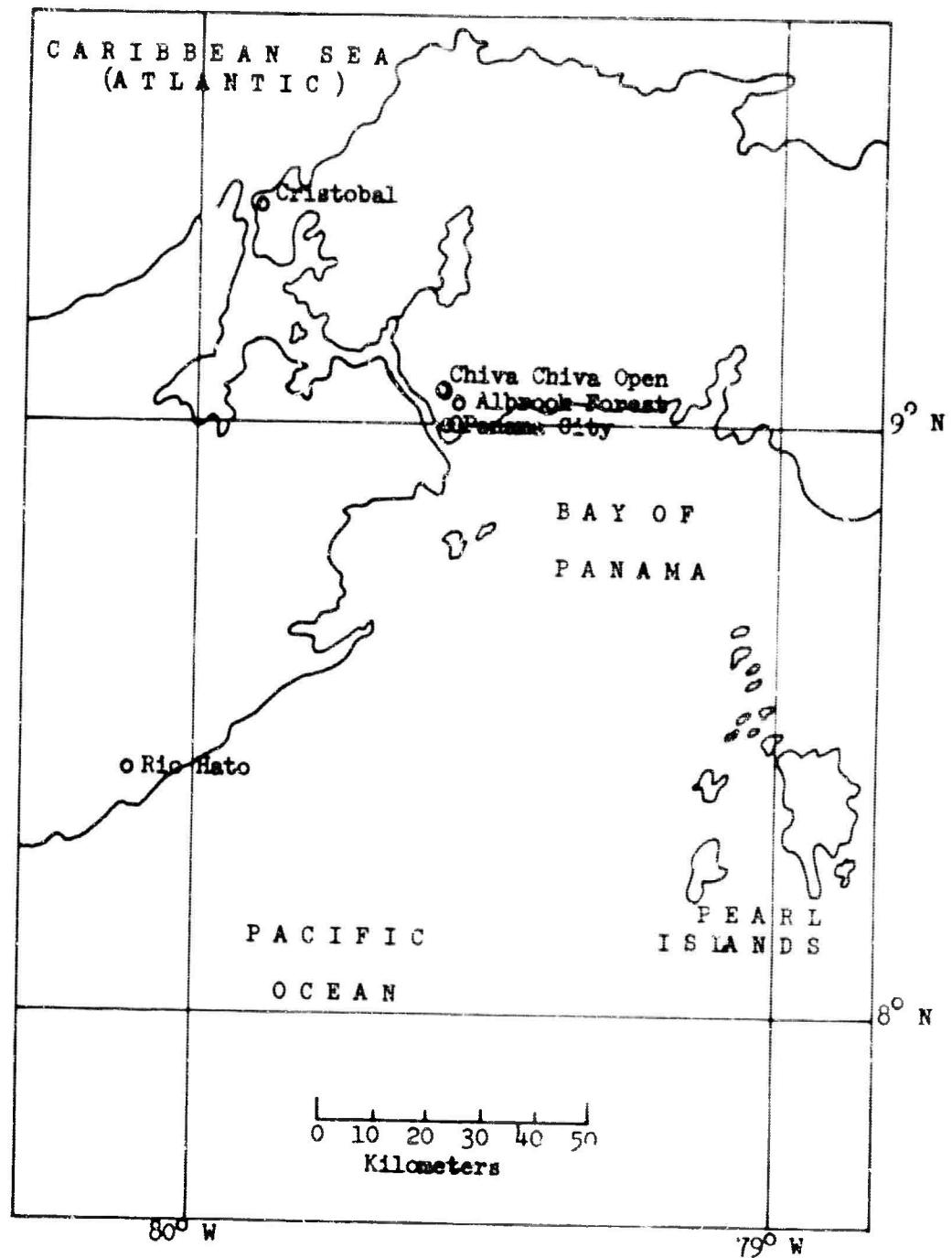


FIGURE 1. LOCATION MAP, Isthmus of Panama

FIGURE 2. FREQUENCY OF OBSERVATIONS

	Height (meters)										
# Element	Sfc.	<u>0.5</u>	<u>1.0</u>	<u>2.0</u>	<u>4.0</u>	<u>8.0</u>	<u>13.5</u>	<u>26.5</u>	<u>28.5</u>	<u>46.0</u>	Frequency
<u>Temperature:</u>											
Dry Bulb	-	1	1	1	1	-	1	1	-	-	Hourly*/Continuously
Wet Bulb	-	1	-	1	1	-	-	-	-	-	Hourly*/Continuously
Grass Minimum	3	-	-	-	-	-	-	-	-	-	Once Daily
<u>WBGT Index</u>											
-	-	1	-	-	-	-	-	-	-	-	Hourly (0600-1900 EST)
<u>Relative Humidity</u>											
-	1	1	1	1	-	-	1	1	-	-	Hourly*/Continuously
<u>Barometric Pressure</u>											
-	-	1	-	-	-	-	-	-	-	-	Continuously
<u>Evaporation</u>											
-	1	-	-	-	-	-	2	2	-	-	Once Daily
<u>Precipitation:</u>											
Recording Gage	-	-	1	-	-	-	-	-	-	-	2 Continuously
Manual Gage	-	-	2	-	-	-	-	-	-	-	4 Times Daily
Stem Flow	-	-	2	-	-	-	-	-	-	-	4 Times Daily
<u>Wind:</u>											
Direction	-	-	-	1	-	-	-	-	-	-	Continuously
Speed	-	-	-	3**	1	-	3**	1	-	-	1 Hourly*/Continuously
1. Albrook and Chiva Chiva											
2. Albrook only											
3. Chiva Chiva only											
** Hourly											
* Observations made with sling psychrometer when recorders are inoperative.											
# Instrument descriptions are contained in the Environmental Data Base semiannual reports.											

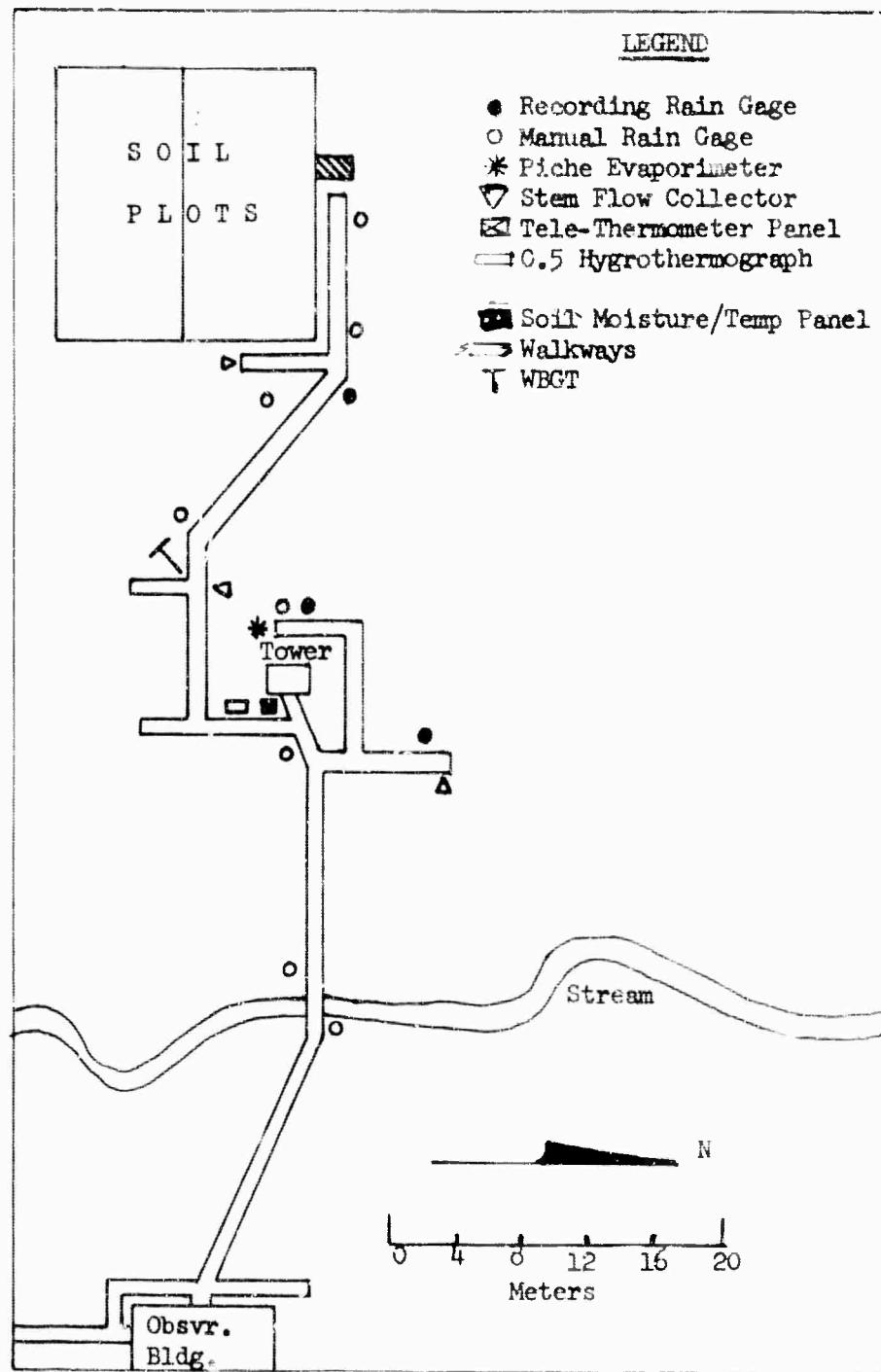


FIGURE 3. ALBROOK FOREST SITE, GENERALIZED PLOT

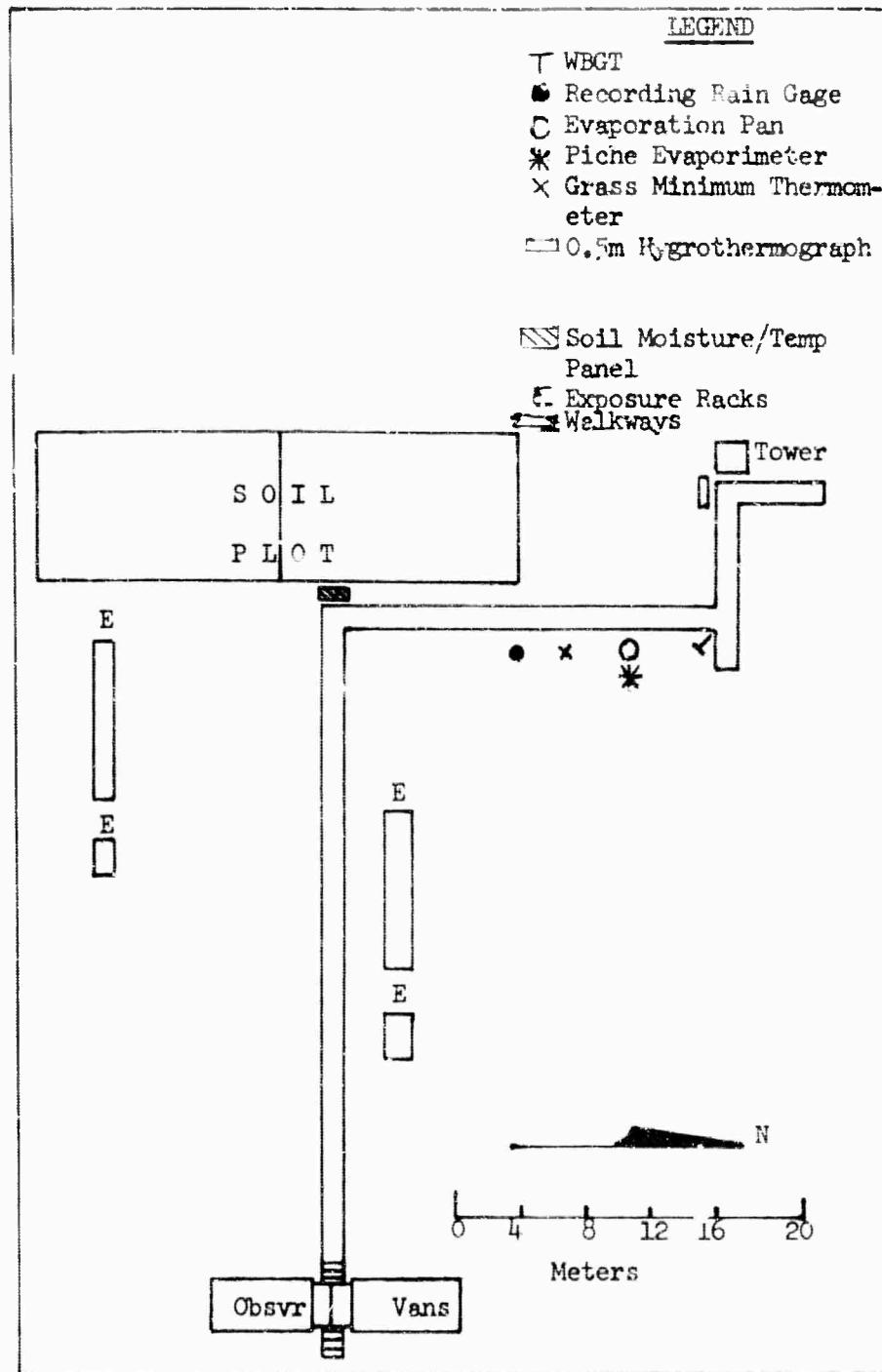


FIGURE 4. CHIVA CHIVA OPEN, GENERALIZED PLOT

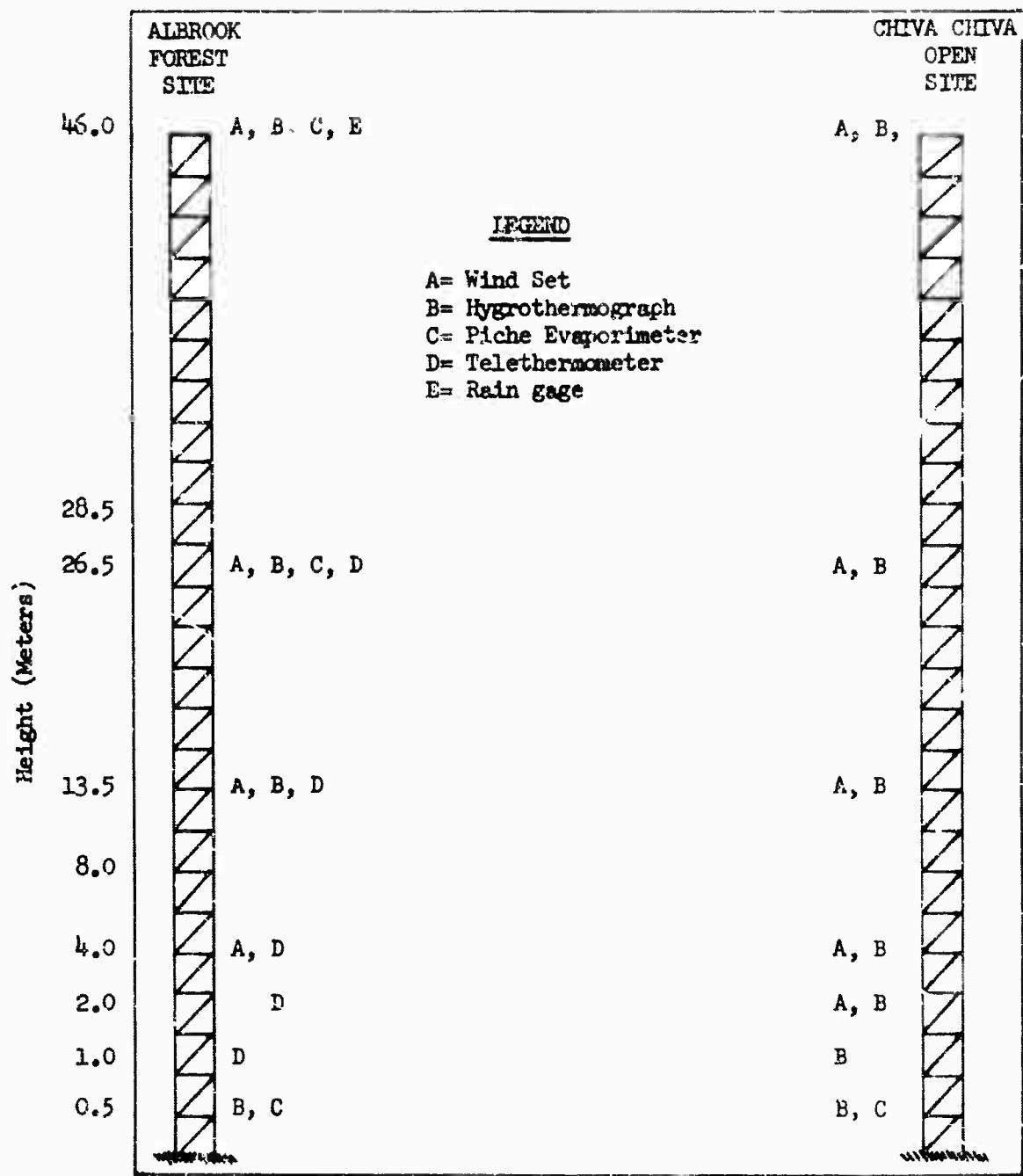


FIGURE 5. INSTRUMENT LOCATION ON TOWERS

SUMMARY OF METEOROLOGICAL OBSERVATIONS
HOUSING DATA

HOURLY DATA

Tilly 367

- * No monthly summary was computed for the ranges.

SUMMARY OF METEOROLOGICAL OBSERVATIONS
HOURLY DATA

JULY 1967

Monthly Means of Air Temperature by Hour
 (°F)

Exposure		Monthly Means of Air Temperature by Hour																								Monthly Summary				
Site	Level	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	No. of Obs.	Min.	Mean	Max.	
(1) Forest Brook	46.0 m	75.3	75.2	75.1	75.6	74.8	74.5	74.8	76.0	76.1	80.3	81.9	83.1	83.3	82.5	81.4	79.1	78.3	77.5	76.5	76.1	75.9	75.8	75.7	75.6	740	71.2	77.6	88.5	
(2) Forest Brook	28.5 m	75.0	74.8	74.6	74.5	74.3	74.2	74.2	74.6	76.0	78.1	80.4	82.1	83.4	83.4	82.7	81.7	79.6	78.7	77.6	76.4	75.8	75.6	75.4	75.3	75.0	74*	71.0	77.5	88.8
(3) Forest Brook	26.5 m	75.0	74.9	74.7	74.4	74.2	74.2	74.0	74.2	75.5	77.2	78.9	80.4	81.3	81.3	81.6	81.4	80.8	79.2	78.3	77.4	76.5	76.0	75.7	75.5	75.2	734	70.9	77.0	86.8
(4) Forest Brook	13.5 m	75.0	74.9	74.7	74.4	74.2	74.2	74.0	74.2	75.5	77.2	78.9	80.4	81.3	81.3	81.6	81.4	80.8	79.2	78.3	77.4	76.5	75.4	75.2	75.0	74*	71.0	77.5	88.5	
(5) Forest Brook	8.0 m	74.6	74.4	74.3	74.1	73.9	73.7	74.3	76.1	77.6	79.0	80.1	81.1	81.1	81.0	80.2	78.6	77.7	76.9	75.9	75.6	75.3	75.2	75.1	75.0	74*	71.0	77.5	88.8	
(6) Forest Brook	2.0 m	74.6	74.4	74.2	74.1	73.9	73.7	74.2	75.9	77.3	78.7	79.9	80.9	80.8	80.8	80.3	78.4	77.6	76.8	75.9	75.7	75.4	75.2	75.0	74.8	74*	71.0	76.6	86.3	
(7) Forest Brook	1.0 m	74.7	74.5	74.3	74.2	73.9	73.7	74.3	75.6	77.2	78.5	79.6	80.6	80.8	80.7	80.1	78.4	77.6	76.8	76.0	75.7	75.4	75.3	75.2	75.0	74*	71.0	76.6	86.3	
(8) Forest Brook	0.5 m	75.1	74.9	74.9	74.9	74.7	74.5	74.5	74.5	75.7	77.0	78.3	79.5	80.4	80.4	80.6	80.7	80.2	78.9	78.2	77.5	76.6	76.1	75.7	75.6	75.4	74*	70.8	76.6	85.8
(9) Forest Brook	0.0 m	75.3	75.4	75.0	74.9	74.7	74.6	74.6	75.7	78.1	80.3	81.8	82.7	83.4	83.7	83.4	82.0	80.5	80.7	80.6	80.4	80.2	79.9	79.2	78.8	78.4	74*	72.0	76.9	86.5
(10) Forest Brook	46.0 m	75.3	75.2	75.1	75.6	74.8	74.5	74.3	74.2	74.6	76.0	78.1	81.9	83.1	83.3	82.5	81.4	79.1	78.3	77.5	76.5	76.1	75.9	75.8	75.5	739	71.6	77.9	88.6	
(11) Forest Brook	28.5 m	75.0	74.9	74.8	74.6	74.5	74.3	74.2	74.2	74.6	76.0	78.2	80.4	82.1	83.4	83.4	82.7	81.0	79.5	78.3	77.6	76.7	76.0	75.8	75.6	75.4	71*	71.0	77.9	89.6
(12) Forest Brook	26.5 m	75.0	74.9	74.8	74.6	74.6	74.5	74.3	74.3	75.6	78.5	80.6	81.9	82.6	83.8	83.8	82.6	81.3	79.5	78.5	77.8	76.7	76.4	76.1	75.9	75.3	74*	71.0	77.9	89.6
(13) Forest Brook	13.5 m	75.1	74.9	74.8	74.6	74.6	74.5	74.3	74.3	75.6	78.5	80.6	81.6	81.9	82.6	82.6	82.6	81.9	81.0	79.5	78.3	77.6	76.7	76.0	75.8	75.6	74*	71.0	77.9	89.6
(14) Forest Brook	8.0 m	74.6	74.4	74.3	74.1	73.9	73.7	74.0	74.0	74.9	75.8	76.1	77.0	78.1	78.1	78.0	77.7	77.0	76.7	76.4	76.2	76.0	75.8	75.6	75.4	74*	71.0	77.9	89.6	
(15) Forest Brook	2.0 m	74.6	74.2	74.2	74.0	73.8	73.6	74.9	77.6	79.9	82.1	83.5	83.5	83.5	83.3	82.3	81.0	79.5	78.3	77.6	76.7	76.4	76.0	75.8	75.5	75.1	738	70.2	78.0	89.8
(16) Forest Brook	1.0 m	74.5	74.2	74.1	73.7	73.6	73.3	73.6	73.6	73.7	73.8	74.0	74.4	74.4	74.4	74.2	74.0	73.8	73.6	73.5	73.4	73.3	73.2	73.1	73.0	72.9	72*	70.9	78.0	91.1
(17) Forest Brook	0.5 m	74.4	74.0	74.0	73.6	73.6	73.3	73.4	73.4	73.5	74.1	74.4	75.7	75.9	75.9	75.9	75.6	75.0	74.9	74.9	74.8	74.7	74.6	74.5	74.4	74*	70.2	78.0	93.2	

SUMMARY OF METEOROLOGICAL OBSERVATIONS
HOURLY DATA

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Exposure		Monthly Means of Relative Humidity by Hour (%)												Monthly Summary																	
Site	Level	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	% of Obs.	Min.	Mean	Max.		
28.0 m	<6.0 m	95	95	95	95	95	95	95	95	93	87	82	78	76	76	77	81	85	87	87	91	93	94	95	95	95	74.0	64	69	97	
28.5 m	26.5 m	95	95	95	95	95	95	95	96	96	92	87	82	78	76	75	77	80	84	86	88	90	94	94	95	95	95	73.4	63	89	98
13.5 m	96	96	96	96	96	96	97	97	96	92	87	85	81	81	81	83	87	87	88	88	91	93	94	95	95	95	73.3	61	91	99	
8.0 m	This level was not instrumented for relative humidity at this time																														
4.0 m	97	97	98	98	98	98	98	98	95	92	90	88	85	87	86	87	90	92	93	94	95	96	97	97	97	97	74.4	67	93	100	
2.0 m	97	97	98	98	98	98	98	98	96	93	91	89	87	89	87	83	91	93	93	95	96	96	97	97	97	97	74.1	70	94	100	
1.0 m	97	98	98	98	98	98	98	97	94	92	91	89	89	89	90	92	94	94	94	95	96	96	97	97	97	97	74.4	67	95	100	
0.5 m	97	97	97	97	98	97	98	97	96	95	93	91	90	91	90	91	93	93	94	95	96	96	96	96	96	96	74.2	77	95	100	

CHIVAS CHIVAS open slate																																
	46.0 m	94	95	95	95	95	95	95	93	88	83	79	77	74	75	77	82	85	87	88	91	91	92	92	93	737	63	88	98			
28.5 m																																
26.5 m	94	95	95	95	95	95	95	95	93	87	83	79	77	74	74	76	81	85	86	88	91	92	92	93	93	94	737	58	88	98		
13.5 m	95	96	95	96	96	96	96	96	93	86	81	78	77	75	75	76	81	85	86	88	91	92	92	93	93	94	738	64	88	99		
8.0 m																																
4.0 m	96	96	96	96	96	96	96	97	97	97	95	89	84	79	76	73	72	75	79	83	86	87	90	92	92	93	94	95	738	57	88	100
2.0 m	96	96	96	96	96	96	96	97	97	97	96	90	85	80	77	73	73	75	79	83	86	88	91	92	93	94	95	95	738	55	89	100
1.0 m	96	97	97	97	97	97	97	97	97	97	96	89	83	80	77	74	75	77	81	85	88	89	92	93	94	95	96	96	729	63	89	100
0.5 m	96	97	96	97	97	97	97	98	97	97	97	91	85	81	73	74	76	71	79	85	84	87	89	92	93	94	95	95	741	60	89	100

SUMMARY OF METEOROLOGICAL OBSERVATIONS
HOURLY DATA

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Exposure	Site	Level	Monthly Ranges of Relative Humidity by Hour (%)																								Monthly Summary*
			01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
Forest	46.0 m	4	6	5	4	4	4	3	12	20	25	26	29	30	31	30	29	26	25	19	11	10	10	9	4		
Forest	28. m	10	12	11	11	10	10	15	16	25	21	22	21	32	33	32	28	22	16	12	12	11	10	11			
Forest	26.5 m	9	9	10	8	6	5	6	10	12	20	25	30	33	35	37	34	31	31	28	22	16	13	12	11		
Forest	13.5 m	8.0 m	8	10	11	11	11	10	10	15	16	25	21	22	21	32	33	32	28	22	16	12	12	11			
Forest	4.0 m	10	11	9	5	6	4	6	11	18	21	25	28	31	32	28	30	27	24	20	12	17	10	10	8		
Forest	2.0 m	10	12	6	5	6	5	6	5	10	15	14	25	26	27	24	25	24	27	22	16	12	10	9	11	7	
Forest	1.0 m	8	8	6	6	5	4	4	7	11	13	20	25	31	24	20	21	25	29	14	12	10	10	11	9		
Forest	0.5 m	6	8	8	7	6	5	7	4	10	12	19	21	19	23	20	15	19	16	13	9	7	8	8	7		

No monthly summary was computed for the ranges.

Chiva Chiva (Open site)		9	9	9	8	8	8	9	22	26	23	27	25	27	28	33	29	23	22	16	12	7	7	10	10	9	
4.6 m	9	9	9	8	8	8	8	9	22	26	23	27	25	27	28	33	29	23	22	16	12	7	7	10	10	9	
2.8.5 m	9	9	9	8	7	9	7	10	22	32	24	26	29	30	32	37	32	27	23	15	10	8	9	8	8	8	
2.6.5 m	8	9	8	7	9	8	7	10	22	32	24	26	29	30	32	37	32	27	23	15	10	8	9	8	8	8	
1.3.5 m	9	10	9	10	9	9	8	13	23	28	21	23	23	24	24	33	29	24	23	17	11	8	10	10	10	10	
0.8 m																											
4.0 m	13	12	10	10	10	8	11	19	28	24	31	30	33	34	40	36	28	23	20	13	0	11	14	14	14	14	
2.0 m	10	10	10	8	8	7	10	17	30	24	31	29	35	34	38	35	29	23	13	12	11	9	11	9	11	9	
1.0 m	9	8	10	10	11	11	11	11	23	32	25	28	28	26	28	37	32	26	24	16	8	11	9	8	8	8	
0.5 m	10	9	8	12	13	13	16	19	27	30	35	36	34	38	38	36	29	27	14	2	11	12	20	20	20	20	

* * * SUMMARY OF METEOROLOGICAL OBSERVATIONS
HOURLY DATA
JULY 1967

Exposure	Site	Monthly Means ² of other Elements by Hour																								Monthly Summary				
		Code ¹	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	% ³	Min.	Max.	
WB	(4.0 m)	W3	73.9	73.8	73.7	73.5	73.3	73.9	75.0	75.7	76.6	77.2	77.5	77.8	77.5	77.2	76.2	75.8	75.2	74.7	74.5	74.5	74.4	74.2	74.4	70.4	75.2	81.2		
WB	(2.0 m)	WB	74.0	73.8	73.8	73.7	73.5	73.3	73.8	75.1	75.7	76.7	77.3	77.8	78.0	77.7	77.4	76.4	76.0	75.3	74.8	74.7	74.6	74.5	74.2	74.4	70.9	75.3	81.0	
WB	(0.5 m)	WB	74.5	74.3	74.2	74.1	73.9	73.8	73.9	75.0	75.9	76.7	77.5	78.0	78.5	78.3	78.0	77.1	76.6	76.1	75.5	75.2	75.1	74.9	74.8	74.7	74.2	70.8	75.7	81.4
BP	Albrook (Forest site)	BP	-753	-738	-727	-722	-724	-729	-746	-733	-766	-773	-772	-762	-742	-724	-706	-698	-696	-702	-717	-736	-756	-766	-775	-767	744	.640	-740	.875
P1		P1	0.00	0.04	0.01	0.01	0.05	0.20	0.15	0.12	0.10	0.01	0.06	0.02	0.02	0.23	0.11	0.35	0.11	0.08	0.05	0.03	0.01	0.01	0.09	0.39	69	0.01	7.91	0.90
P2		P2	0.00	0.01	0.02	0.02	0.00	0.03	0.03	0.32	0.32	0.26	0.07	0.06	0.04	0.04	0.38	0.06	0.40	0.08	0.02	0.00	0.01	0.00	0.00	0.22	37	0.01	4.76	0.69
P3		P3	0.00	0.05	0.00	0.00	0.00	0.03	0.20	0.25	0.06	0.11	0.03	0.09	0.00	0.00	0.77	0.05	0.48	0.34	0.06	0.00	0.00	0.00	0.50	25	0.01	4.99	0.77	
P4		P4	0.00	0.02	0.00	0.00	0.03	0.21	0.27	0.22	0.07	0.04	0.02	0.00	0.00	1.20	0.14	0.47	0.21	0.03	0.01	0.00	0.02	0.00	0.01	0.25	41	0.01	7.97	1.20

WB	(4.0 m)	WB	73.8	73.6	73.4	73.4	73.1	73.9	75.2	75.8	76.5	77.0	77.3	77.4	77.2	76.8	76.3	75.8	75.4	74.9	74.8	74.5	74.2	74.1	7.8	70.2	75.1	80.3			
WB	(2.0 m)	WB	73.7	73.5	73.4	73.3	73.2	73.1	74.0	75.4	76.2	77.0	77.6	78.0	78.3	77.1	77.8	77.2	76.5	75.9	75.4	74.9	74.8	74.7	74.5	74.1	74.0	73.8	70.3	75.2	81.5
WB	(0.5 m)	WB	73.6	73.3	73.2	73.1	73.1	73.0	74.3	76.1	77.2	78.2	79.0	79.4	78.7	77.4	76.5	75.9	75.3	74.7	74.6	74.4	74.2	73.8	73.7	74.1	68.3	75.5	83.1		
BP	Chitva (Open site)	BP	.849	.844	.823	.818	.818	.824	.838	.851	.864	.870	.861	.840	.824	.807	.797	.795	.800	.814	.834	.852	.862	.870	.865	.744	.740	.837	.950		
PS		PS	0.09	0.00	0.00	0.03	0.09	0.44	0.23	0.25	0.07	0.02	0.07	0.05	0.26	0.79	0.06	0.35	0.06	0.02	0.00	0.00	0.05	0.11	57	0.01	10.55	1.66			

¹ WB = Wet bulb temperature ($^{\circ}$ F)
BP = Barometric pressure (in. of Hg minus 29.0)

PS = Precipitation at 1.0 m. in open area (in.)
P1 = Precipitation at 46.0 m. above canopy (in.)

P2 = Precipitation under drip canopy (in.)
P3 = Precipitation under open canopy (in.)

P4 = Precipitation under full canopy (in.)
2 Monthly means of precipitation are computed for precipitation days.
Precipitation totals are substituted for the mean in the monthly summary.

SUMMARY OF METEOROLOGICAL OBSERVATIONS
HOURLY DATA

JULY 1957

Site	Code ¹	Monthly Ranges ² of other Elements by Hour																							
		01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
(Forest Site)	WB (4.0 m)	4.3	4.2	3.3	3.5	3.9	4.9	5.6	6.2	7.0	6.5	6.3	6.0	7.2	7.7	6.5	5.8	4.5	4.3	4.8	4.3	4.2	4.5	4.6	4.7
	WB (2.0 m)	4.2	4.1	3.7	3.4	3.8	5.0	5.1	6.0	7.3	6.3	6.2	6.0	6.6	7.7	7.7	5.7	5.1	5.5	4.4	4.1	4.1	4.4	4.1	4.5
	W3 (0.5 m)	3.7	3.6	3.4	3.7	3.8	4.1	4.8	6.0	7.2	6.4	5.8	5.8	4.9	7.2	6.9	6.7	5.6	5.9	4.4	4.4	4.1	4.0	4.1	3.6
	BP	-120	-125	-135	-140	-120	-145	-160	-170	-140	-130	-135	-140	-140	-135	-120	-125	-110	-115	-120	-125	-115	-120	-115	-130
Abrook	P1	0.00	0.05	0.00	0.00	0.05	0.51	0.35	0.12	0.22	0.01	0.02	0.00	0.02	0.06	0.19	0.86	26	0.19	0.13	0.03	0.00	0.00	0.00	0.00
	P2	0.00	0.00	0.00	0.00	0.02	0.54	0.19	0.13	0.09	0.00	0.00	0.00	0.00	0.33	0.01	0.68	0.13	0.02	0.20	0.00	0.00	0.00	0.00	0.00
	P3	0.00	0.01	0.00	0.00	0.00	0.45	0.39	0.08	0.15	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.55	0.47	0.10	0.00	0.00	0.00	0.00	0.00
	P4	0.00	0.01	0.00	0.00	0.00	0.67	0.63	0.24	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.50	0.09	0.00	0.00	0.00	0.00	0.00	0.48

* No monthly summary
was computed for
the ranges.

Site	Code ¹	Monthly Summary*																							
		01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
(Forest Site)	WB (4.0 m)	5.3	5.1	4.6	5.1	4.9	5.2	5.8	7.5	8.7	7.3	6.1	5.8	6.1	5.2	6.4	7.1	6.2	5.3	4.6	4.4	4.2	3.6	4.3	4.9
	WB (2.0 m)	5.0	4.8	4.4	4.4	4.6	5.2	5.7	7.7	9.1	7.6	6.6	6.0	7.3	5.4	6.9	7.1	6.6	5.1	4.6	3.9	3.9	3.8	4.1	4.8
	W3 (0.5 m)	5.2	4.7	4.7	5.6	6.0	9.5	7.5	8.4	9.0	8.9	8.2	7.7	7.5	9.6	7.2	7.8	4.7	4.5	4.9	3.7	5.0	7.5	8.5	
	BP	-125	-125	-135	-130	-125	-155	-155	-130	-125	-130	-135	-135	-135	-130	-130	-130	-120	-125	-120	-120	-115	-115	-115	
Chiva Chiva	PS	0.00	0.00	0.00	0.04	0.20	0.23	0.46	0.45	0.11	0.01	0.11	0.07	0.74	1.65	0.12	1.42	0.13	0.02	0.00	0.00	0.00	0.00	0.00	
	CP																								

WB = Wet bulb temperature (°F)
BP = Barometric pressure (in. of mercury 29.92)

2 Monthly ranges of precipitation are computed for precipitation days.

PS = Precipitation at 1.0 m. in open area (in.)
P1 = Precipitation at 46.0 m. above canopy (in.)
P2 = Precipitation under full canopy (in.)

P3 = Precipitation under drip canopy (in.)
P4 = Precipitation under open canopy (in.)

SUMMARY OF METEOROLOGICAL OBSERVATIONS
HOURLY DATA

JULY 1967

Exposure	Site	Level	Monthly Means of Wind Speed by Hour (miles/hr.)																								Monthly Summary					
			01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	No. of days	Min.	Mean	Max.		
Abrook (Forest Site)	46.0 m	5	6	6	6	6	6	6	6	6	6	5	6	7	7	9	8	8	8	7	7	6	6	6	5	6	17					
	28.5 m																															
	26.5 m	3	2	2	2	2	2	2	2	2	2	1	2	3	3	4	4	4	4	3	3	3	2	2	3	3	2	449	0	3	12	
	13.5 m																															
	8.0 m																															
	4.0 m	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6.69	0	0	6	
	2.0 m																															
	1.0 m																															
	0.5 m																															

Exposure	Site	Level	Monthly Means of Wind Speed by Hour (miles/hr.)																								Monthly Summary				
			01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	No. of days	Min.	Mean	Max.	
Chiva Chiva (Open Site)	46.0 m	5	4	5	4	4	5	4	5	6	5	6	7	7	8	8	9	7	8	8	7	6	5	6	5	371	0	6	18		
	28.5 m																														
	26.5 m	4	3	3	3	3	4	3	4	5	5	4	7	6	8	8	8	7	7	5	5	4	4	5	4	5	575	0	5	21	
	13.5 m	2	1	2	1	1	1	1	1	1	1	1	3	3	4	4	5	5	7	6	6	5	4	4	3	2	2	733	0	3	18
	8.0 m																														
	4.0 m	3	2	2	2	2	3	2	3	2	3	2	3	2	3	3	4	4	5	6	6	5	4	4	3	2	3	673	0	4	14
	2.0 m	1	0	1	0	0	0	0	0	0	0	0	1	1	2	2	3	3	4	4	3	3	2	2	1	1	1	734	0	2	12
	1.0 m																														
	0.5 m																														

Note: Data at 46.0 meters represent the first 21 days of the month only.

SUMMARY OF METEOROLOGICAL OBSERVATIONS
HOURLY DATA

JULY 1967

Exposure	Site	Level	Monthly Ranges of Wind Speed by Hour (miles/hr.)																								Monthly Summary*
			01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
	46.0 m	9	12	11	5	10	11	11	10	11	13	16	11	12	10	16	10	13	12	13	10	11	10	11			
	28.5 m																										
	26.5 m	6	4	6	4	5	5	5	6	7	9	12	9	7	9	7	8	8	7	7	5	5	8	7	5		
	13.5 m																										
	8.0 m																										
	4.0 m	0	1	3	2	1	6	1	1	2	2	1	2	2	2	2	1	1	1	1	1	1	1	0			
	2.0 m																										
	1.0 m																										
	0.5 m																										

* No monthly summary
was computed for
the ranges.

Exposure	Site	Level	Monthly Ranges of Wind Speed by Hour (miles/hr.)																								Monthly Summary*
			01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
	46.0 m	12	8	8	7	12	11	10	8	10	11	14	14	11	13	9	10	11	8	11	7	8	12	10			
	28.5 m																										
	26.5 m	13	14	13	6	8	16	6	6	7	7	11	13	19	16	14	11	9	12	9	9	7	9	7			
	13.5 m	10	10	10	5	5	6	4	5	8	7	12	13	18	11	12	10	10	10	6	9	8	7	9	8		
	8.0 m																										
	4.0 m	7	7	5	5	14	6	5	5	7	8	11	11	11	9	10	9	11	9	9	7	8	9	7			
	2.0 m	5	5	4	3	3	4	1	3	5	5	7	8	10	7	12	8	8	7	6	7	6	6	7	6		
	1.0 m																										
	0.5 m																										

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Note: Data at 46.0 meters represent the first 21 days of the month only.

ALBROOK (Forest site) JULY 1967

Relative Frequencies* of Wind Directions by Hour at 46.0 m.

	(%)																										
Hr.	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24			
Dkr.	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.2	3.3	3.3	3.3	10.0			6.4	10.0	13.7	13.7	10.3	3.4	10.7	6.8	10.3	3.5			
N													3.3		3.3	3.3	3.2	10.0	6.8								
NNE															3.3	3.3	3.3	3.2	10.0	6.8							
NE															3.3	3.3	3.3	3.2	10.0	6.8							
ENE															3.3	3.3	3.3	3.2	10.0	6.8							
E															3.3	3.3	3.3	3.3	3.3	6.8							
ESE															3.3	3.3	3.3	3.3	3.3	6.8							
SE															3.3	3.3	3.3	3.3	3.3	6.8							
SSE															3.3	3.3	3.3	3.3	3.3	6.6							
S															6.6	10.0	10.0	10.0	10.0	9.7							
SSW															6.6	6.6	3.3										
SW															3.4	3.3	3.3	3.3	3.3	6.6							
WSW															3.4	3.3	3.3	3.3	3.3	6.6							
W															10.3	3.4	17.1	10.0	6.6	20.0	13.3	10.0	3.4	10.3	3.5	3.5	
WNW															17.1	3.4	20.0	13.3	6.6	26.6	12.9	26.6	20.6	13.7	13.7	6.8	
NW															27.3	41.0	20.6	20.6	24.0	20.0	13.3	29.9	20.0	10.0	6.6	10.0	22.6
NNW															13.7	27.3	34.1	41.0	34.1	27.3	13.3	23.3	6.6	20.0	29.0	20.6	41.0
CALM															6.8	6.8	10.3	10.3	6.8	20.0	10.0	16.6	3.2	6.6	17.1	10.3	14.2

* Note: Due to rounding, percentage totals do not equal 100%.

▼ IMPREGNATED ■ DRY

ALBROOK (Forest site) JULY 1967

Relative Frequencies* of Wind Directions by Hour at 26.5 m.

Dir.	(%)																								
	Hr 01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
N	15.4	11.5	7.6	7.6	7.6	3.8	7.3	7.0	14.2	6.8	3.5	10.7	7.0	3.5	6.0	10.3	7.0	7.0	14.2	10.7	11.0	3.8	16.0		
NNE	3.8					3.8				3.5	3.4	7.0		3.5		3.3	10.3	7.0	3.5	3.5	1.1	2	3.6		
NE	3.8									3.4	3.5	3.5				6.6	3.4	10.7	3.5			3.5		4.0	
ENE																		6.8	3.5						
E						3.8	3.6	3.5																	
ESE																3.5		3.3							
SE																3.5	10.7	3.3							
SSE																3.5	10.7	6.6	3.4						
S																									
SSW																									
SW	3.8					3.8				3.5	3.5	7.0	14.2	14.2	3.5										
WSW																									
W	3.8	3.8																							
WNW	7.6	15.4	7.6	7.6	11.5	7.6	7.3	21.3	10.7	13.7	10.7	10.7	7.0	14.2	16.6	17.1	7.0	3.5	7.0	3.5	11.0	7.0	11.5		
NW	30.7	26.9	38.3	7.6	30.7	26.9	18.4	24.9	28.4	24.0	10.7	14.2	7.0	14.2	26.6	30.7	24.9	39.0	31.9	24.9	11.0	31.9	26.9	32.0	
NNW	23.1	30.7	46.0	19.1	26.9	22.1	14.2	17.7	10.3	24.9	10.7	17.0	14.2	10.0		7.0	21.3	17.7	7	4	24.9	34.5	28.0		
CALM	11.5	7.6	15.4	19.1	23.1	19.1	33.1	21.3	14.2	20.6	10.7	10.7	7.0	10.7	10.0	13.7	14.2	17.7	17.7	21.3	14.7	24.9	19.1	12.0	

* Note: Due to rounding, percentages totals do not equal 100%.

IMPERFECTA, ■ = FRESH

ALBROOK (Forest site) JULY 1967

Relative Frequencies* of Wind Directions by Hour at 4.0 m.

Dir.	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
N						3.8	3.8			3.8	3.8		3.8		3.8	7.3	4.0	7.9	4.0					4.0	
NNE																	7.6	7.9							
NE																									
ZNE																	3.6								
E																									
ESE																									
SE																									
SSE																									
S																									
SSW																									
SW																									
WSW																									
W																									
WNW																									
NW																									
NNW																									
CALM	95.4	91.9	84.5	92.1	92.1	88.3	92.0	84.5	65.2	72.9	72.9	72.9	72.9	62.5	69.1	68.0	72.0	76.0	84.0	92.0	92.0	92.0	92.0	95.7	

• Note: Dir. totals do not equal 100%.

*Fig. percentage totals.

CHIVA CHIVA (Open site) JULY 1967

Relative Frequencies* of Wind Directions by Hour at 46.0 m.

	(%)																							
Hr.	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
N	11.7	5.9							4.8						5.0	5.0	5.0					15.0	16.7	16.7
NNE															5.0									
NE															5.0									
ENE															5.0									
E															5.0									
ESE															5.0									
SE															5.0									
SSE															5.0									
S															5.0									
SSW															5.0									
SW															5.0									
WSW															5.0									
W	17.6	5.9	6.3	5.9	23.8	4.8	23.8			9.5	10.0	5.0	10.0		5.0								5.0	5.6
WNW	29.3	29.3	11.7	41.0	18.7	29.3	23.8	47.0	33.3	23.8	19.0	15.0	25.0	35.0	30.0	20.0	20.0	15.0	30.0	25.0	15.0		11.1	
NW	23.4	52.8	58.5	35.2	43.6	46.9	23.8	28.6	19.0	52.4	38.1	40.5	20.0	15.0	35.0	55.0	40.0	45.0	65.0	60.0	55.0	50.0	38.9	
NNW	5.9	17	11.7	6.3	11.7	19.0	9.5	4.8	4.3	5.5	15.0	20.0	10.0	10.0	25.0	25.0	10.0	5.0	10.0	10.0	22.2	11.1		
CAIM	11.7	11.7	11.7	5.9	12.4	9.5	4.2															5.6	11.1	

* Note: Due to rounding, percentage totals do not equal 100%.

CHIVA CHIVA (Open site) JULY 1967

CHIVA CHIVA (Open site); JULY 1967

Relative Frequencies * of Wind Directions by Hour at 26.5 m.
(%)

Dir.	Hr.																							
	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
N	12.9	12.9	16.1	6.6	16.6	3.3	6.4	9.7	3.2	6.4	9.7	6.4	22.6	3.2	6.4	3.2	16.1	12.9	9.7	16.1	9.7	3.3	10.3	
NNE	3.2	3.2	6.4	3.3	3.3	3.2				3.2			3.2	6.4	2						3.2	3.2	6.6	6.8
NE	3.2	3.2	3.3						6.4	3.2			6.4			6.4						3.2	3.2	3.3
ENE																								
E																								
ESE																								
SE																								
SSE																								
S																								
SSW																								
SW																								
WSW																								
W	12.9	3.2	3.2	3.3	6.6	13.3	9.7	16.1	6.4	3.2	9.7	12.9	9.7	9.7	9.7	9.7	9.7	9.7	9.7	9.7	9.7	9.7	9.7	9.7
WNW	9.7	12.9	20.0	16.6	13.3	12.9	12.9	12.9	12.9	12.9	12.9	12.9	12.9	12.9	12.9	12.9	12.9	12.9	12.9	12.9	12.9	12.9	12.9	12.9
NW	16.1	22.6	25.8	23.3	39.9	20.6	12.4	19.4	29.1	38.7	22.6	19.4	22.6	25.8	32.2	38.7	32.2	22.6	41.9	41.9	32.2	35.5	20.0	24.0
NNW	19.4	16.1	22.6	23.3	13.3	20.0	19.4	12.9	12.9	12.9	16.1	29.0	12.9	12.9	19.4	29.0	32.2	25.0	29.0	22.6	22.6	53.1	20.6	
CAIM	16.1	16.1	19.4	10.0	10.0	6.6	12.9					3.2	6.4								3.2	3.2		

* Note: Due to rounding, percentage totals do not equal 100%.

SINCE 1948

CHIVA CHIVA (Open site) JULY 1967

Relative Frequencies* of Wind Directions by Hour at 4.0 m.
(%)

Hr.	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
Dir.																									
N	24.0	10.3	17.1	6.8	14.2	13.7	6.4	6.4	16.1	16.1	19.4	6.4	9.7	6.4	11.1	16.1	16.1	6.4	29.0	12.9	13.3	16.6			
NNE		6.8	3.4	3.4	7.0	3.4		3.4		3.2	3.2	6.4	3.2	3.2	6.4									3.2	6.4
NE	10.3	13.7	6.8	10.3		3.4	6.4	3.2	6.4			3.2		3.2										3.2	6.6
ENE	3.4					6.8	3.2	3.2		5.2	3.2													3.2	6.6
E	3.4		6.8	3.4	3.5	6.8	3.2	3.2						6.4										3.2	3.2
ESE						3.4	6.4			3.2	3.2		6.4											3.3	
SE																								6.4	3.3
SSE																									
S																									
SSW																									
SW																									
WSW																									
W																									
WNW																									
NW																									
NNW																									
CALM																									

* Note: Due to rounding, percentage totals do not equal 100%.

Temperature: °C

SUMMARY OF NON HOURLY DATA

JULY 1967

Summary of Elements with Non-hourly Frequencies of Observations						
Site	Element, Units and Exposure	Description	Number of Obs.	Minimum Value	Mean or Total Value	Maximum Value
	WBGT Index ¹ (at 1.0 meters)	Index value Dry bulb temp. Wet bulb temp. Black bulb temp.	434 434 434 434	70.5 70.5 70.3 71.0	77.0 77.9 76.5 78.5	82.8 86.0 82.0 88.0
	Evaporation ³ (at 4 levels)	Piche (46.0 m) Piche (26.5 m) Piche (13.5 m) Piche (0.5 m)	29 28 27 26	0.043 0.043 0.006 0.006	5.921* 5.392* 1.641* 0.814*	0.470 0.518 0.140 0.085
Altbrook (Forest site)	Precipitation from Raingauge Network ² (in. at 1.0 meters)	Gauge # 1 Gauge # 2 Gauge # 3 Gauge # 4 Gauge # 5 Gauge # 6 Gauge # 7 Gauge # 8	27 28 28 27 28 28 28 28	0.01 0.01 0.01 0.01 0.01 0.01 0.01 0.01	5.18* 8.44* 8.41* 8.39* 7.24* 7.34* 8.01* 7.17*	1.04 1.10 1.23 1.26 1.20 1.05 1.25 1.15
	Stem Flow ² (in. at 2.0 meters)	Small tree Medium tree Large tree	26 23 20	0.01 0.01 0.01	8.81* 9.32* 39.75*	2.00 2.00 11.49
	WBGT Index ¹ (at 1.0 meters)	Index value Dry bulb temp. Wet bulb temp. Black bulb temp.	432 432 432 432	69.8 70.0 69.8 70.0	79.7 80.5 77.0 88.6	89.6 94.8 83.3 118.1
Chuva Chiva (Open site)	Evaporation ³ (in. a ^{0.5} meters)	Piche Pan	31 27	0.006 0.021	4.025* 3.653*	0.482 0.287
	Minimum Grass temp. ³ (°F at grass tips)	None	29	67.5	70.7	74.0

* Total Values

1 - Hourly observations between 0600 and 1900 hours inclusive

2 - Six hourly observations

3 - Daily observations

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13. ABSTRACT This report contains detailed microclimatic data for July 1967 from specific sites in the Panama Canal Zone and vicinity. The data are presented in tabular form, summarized for hourly and/or daily observations from surface to 46-meter levels. Elements listed are: temperature, pressure, precipitation, wind speed and direction, relative humidity, and evaporation.		

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LINK A

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